

Modern Chemical Materials for the Rubber Industry

SOV/63-4-1-4/31

amine is extensively used. Orthotolyl- $\beta$ -naphthylamine is an age resistor for synthetic rubbers. Among the alkylphenols the most effective compounds are of the type 2,4,6-trialkylphenol. As accelerators of plastication thio- $\beta$ -naphthol is very effective, but also very toxic. Pentachlorothiophenol, di-o-benzamidophenyldisulfide and its zinc salt are widely in use. A special plasticizer for butadiene-styrene and nitrile rubbers is dimethylphenylparacresol. As plasticizers petroleum products, like asphalt-bitumic substances or chlorinated paraffins, are employed, as well as rosins, or organic substances, e.g. butadiene-akrylonitrile copolymers and alkyl-phenolaldehyde resins. Carbon blacks are the most important fillers. They are produced in different types: NRS which is processed with difficulty; YeRS which is easily processed; and the medium type MRS. Organic fillers are thermoplastic high-molecular substances. White fillers are used for the production of colored rubbers. Silicon fillers, like aerosil, are extremely pure ( $\text{SiO}_2$  99.99%). Calcium, aluminum and zirconium silicates are also employed. Precipitated and activated types of

Card 2/3

Modern Chemical Materials for the Rubber Industry

SOV/63-4-1-4/31

calcium carbonate are synthetic mineral fillers.  
There are 103 references, 35 of which are Soviet, 60 English,  
5 German and 3 Japanese.

Card 3/3

FEL'DSHTEYN M.S.; EYTINGON, I.I.; PEVZNER, D.M.; STREL'NIKOVA, N.P.;  
DOGADKIN, B.A.

Study of a series of derivatives of-mercaptobenzethiazele and  
dimethyldithiocarbamic acid as vulcanisation accelerators. Kauch.  
i res. 18 no.1:16-21 Ja '59. (MIRA 12:1)

1. Nauchno-issledovatel'skiy institut shinney promyshlennosti.  
(Vulcanisation) (Benzethiazele) (Carbamic acid)

SHISHKONOV, N.S. (Khar'kov); FEL'DSHTEYN, M. S.

Letter to the editor. Kauch. i rez. 18 no.1:59 Ja '59.  
(MIRA 12:1)

1. Gumkhiuprem.  
(Vulcanization)

5(4)

SOV/69-21-4-10/22

AUTHOR: Dogadkin, B.A., Eytingon, I.I., Fel'dshteyn, M.S., Tarasova Z.N., Gur'yanova, Ye .N., Lin Yang Ch'in, Klauzen, N.A. and Pevzner, D.M.

TITLE: Vulcanization of Rubber in the Presence of Aminomethyl Derivatives of 2-Mercaptobenzothiazole

PERIODICAL: Kolloidnyy zhurnal, 1959, Vol XXI, Nr 4, pp 427-435 (USSR)

ABSTRACT: The authors synthesized a number of compounds, condensation products of 2-mercaptobenzothiazole and formaldehyde with various amines, to test them as accelerators of vulcanization in mixtures of synthetic and natural rubbers. According to the data of spectral analysis, the chemical structure of these 2-mercaptobenzothiazole derivatives is characterized by the presence of a -S-C-N- group. The experiments proved that aminomethyl derivatives of 2-mercaptobenzothiazole are effective accelerators of the vulcanization process. Figure 3 (graph) shows the vulcanizing activity of these derivatives in comparison with

Card 1/2

SOV/69-21-4-10/22

Vulcanization of Rubber in the Presence of Aminomethyl Derivatives of  
2-Mercaptobenzothiazole

the effect of sulfenamide accelerators. It was further found that vulcanization of rubber mixtures with aminomethyl derivatives is characterized by higher rates in the initial period as compared with vulcanization of mixtures containing sulfenamide accelerators. In comparison with the latter, aminomethyl derivatives enter into isotopic exchange with di-2-benzothiazolyl-disulfide at lower temperatures (graphs 6 and 7). Aminomethyl derivatives of 2-mercaptobenzothiazole do not exert an independent structurizing (vulcanizing) effect on rubber (table 3). In this respect they differ from the sulfenamide compounds. There are 7 graphs, 3 tables and 7 Soviet references.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti,  
Moskva (Scientific Research Institute of the Tire Industry,  
Moscow)

SUBMITTED: 23 December, 1958  
Card 2/2

3(5)

AUTHORS:

Eytingon, I. I., Strel'nikova, N. P.,  
Fel'dashteyn, M. S.

SOV/79-29-6-56/72

TITLE:

Synthesis of Some 1,4-Piperazine-bis-carbothiosulfonamides  
(Sintez nekotorykh 1,4-piperazin-bis-karbotiosul'fenamidov)

PERIODICAL:

Zhurnal obshchey khimii, 1959, Vol 29, Nr 6, pp 2032-2034 (USSR)

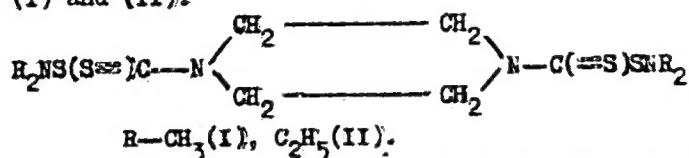
ABSTRACT:

There are contradictory data in technical literature on the chemical character of products of the conversion of equimolecular quantities of piperazine and carbon disulfide. The fine-crystalline end product of this reaction corresponds to the empirical formula  $C_5H_{10}N_2S_2$ . This compound, called "thioid", is used as a vermifuge, as well as for analytic determination of cobalt in the presence of nickel and copper. T. Pavolini and F. Gambarin (Ref 2) heated the thioid with 0.1 normal solution of KOH and obtained the neutral salt  $C_{10}H_{16}N_4S_4K_2$ , which according to their opinion points to the presence of a complex of compounds with two sulfhydryl groups. I. Dunderdale and F. Watkins (Ref 3) dissolved the thioid in an alkaline lye and obtained after treatment of the solution with benzyl chloride, a mixture composed of benzyl esters of the piperazine-carbodithio-1- and piperazine-dicarbodithio-1,4-acid.

Card 1/3

Synthesis of Some 1,4-Piperazine-bis-carbothiosulfonamides SOV/79-29-6-56/72

According to these scientists the initial product is a complex consisting of structural units of the mono- and dicarbothio-acids of piperazine. The authors obtained by conversion of carbon-disulfide with piperazine in an alkaline medium, and by subsequent oxidizing condensation of the reaction product with the corresponding secondary aliphatic amines, two until present unknown compounds: (I) and (II):



This synthesis leads to the assumption that, in the conversion of piperazine with carbon-disulfide in an alkaline medium the formation of the acid (III) takes place, which serves as an intermediate product for the synthesis of sulfonamido derivatives, followed by an oxidizing condensation with the amines (Scheme). The two compounds obtained are adequately efficient accelerators for the sulfur vulcanization of natural and synthetic butadiene-styrene rubber. There are 3 references.

Card 2/3



Synthesis of Some 1,4-Piperazine-bis-carbothiosulfonamides SOV/79-29-6-56/72

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(Scientific Research Institute for Pneumatic Tire Industry)

SUBMITTED: May 9, 1958

Card 3/3

SOV/80-32-4-34/47

5(3), 15(9)

AUTHORS: Fel'dshteyn, M.S., Dogadkin, B.A., Eytingon, I.I., Shcherbachev, G.P. and Strel'nikova, N.P.

TITLE: On the Problem of the Effect of the Chemical Structure of Sulfenamide Compounds on Vulcanization Activity (K voprosu o vliyaniy khimicheskoy struktury sul'fenamidnykh soyedineniy na vulkanizatsionnuyu aktivnost')

PERIODICAL: Zhurnal prikladnoy khimii, 1959, Vol 32, Nr 4, pp 893-901 (USSR)

ABSTRACT: The authors investigated the effect of various sulfenamide compounds as vulcanization accelerators with an aim to find a correlation between their vulcanization activity and chemical structure. Representatives of the two classes of these compounds, namely derivatives of the mercaptobenzothiazole and dimethyldithiocarbamic acid, were studied. The effectiveness of their action as accelerators was investigated on mixtures which consisted of butadiene-styrol rubber (SKS-30A). The effect of accelerators on the kinetics of vulcanization is shown in Figure 1 according to data of sulfur addition, in Figure 2 according to the changes in solubility in chloroform, and in Figure 3 according to the changes in the value of the equilibrium module. The kinetic curves of vulcanization presented in Figures

Card 1/2

SOV/80-32-4-34/47

On the Problem of the Effect of the Chemical Structure of Sulfenamide Compounds  
on Vulcanization Activity

1 and 2 show the presence of an initial delayed period of vulcanization. Therefore, the authors conclude that this peculiarity prevents the phenomenon of premature vulcanization and ensures a more lasting staying of the mixtures in the visco-flowing state, which is of importance for manufacturing monolithic multi-layer items. The application of the described accelerators of vulcanization is considered as technologically expedient, for instance in the manufacture of tire treads.

There are 12 graphs, 1 table and 7 references, 5 of which are Soviet and 2 English.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(Scientific Research Institute for Tire Industry)

SUBMITTED: December 11, 1957

Card 2/2

5 (1), 5 (2), 5 (3)

AUTHORS:

Fel'dshteyn, M. S., Eytingon, I. I.,  
~~Dogadkin, B. A.~~

SOV/20-128-4-28/65

TITLE:

The Vulcanization Effect of 2-Mercaptobenzothiazol Derivatives

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 128, Nr 4, pp 736 - 739  
(USSR)

ABSTRACT:

The problem of finding vulcanization systems, particularly vulcanization accelerators, with given properties is complicated by the fact that the influence of the chemical structure of these accelerators on their vulcanization activity has not yet been clarified. Therefore, experimental investigations in this respect are interesting both from a theoretical and practical point of view. The present paper investigates the vulcanization effect of several, chemically different sulphene-amide derivatives of the substance mentioned in the title (see Scheme). They were: N,N-diethyl-2-benzothiazol-sulphene amide (1), N-oxy-diethylene-2-benzothiazol-sulphene amide (2), N-cyclohexyl-2-benzothiazol-sulphene amide (3), N,N-dicyclohexyl-2-benzothiazol-sulphene amide (4), and N-phenyl-2-benzothiazol-sulphene amide (5). Figure 1 (Curve 3) shows that, by use of (2), the induction period of the vulcanization is more distinct-

Card 1/3

The Vulcanization Effect of 2-Mercaptobenzothiazol  
Derivatives

SOV/20-128-4-28/65

ly marked than by use of (1) and (3) (Curves 1 and 2). A considerable extension of the induction period is observed in the transition from (3) to (4) (Curve 4). The vulcanization activity is also reduced by replacing the cyclohexyl radical by a phenyl radical. Thus, it was proved that - by introducing radicals of different structure into the amino group of benzothiazol-sulphene amides - accelerators can be produced which considerably differ from each other with respect to their vulcanization activity. This applies particularly to the duration of the induction period of vulcanization. A thesis established by the authors is of interest, according to which a rapid acceleration of vulcanization in the initial stage is observed on transition from the sulphene-amide compounds with a character-

istic group - S - N - to compounds containing the groups

- S - C - N - (Fig 2). The data on the change in maximum swelling, also mentioned here, show that the structuration effect appears at an earlier vulcanization stage in the presence

Card 2/3

The Vulcanization Effect of 2-Mercaptobenzothiazol  
Derivatives

SOV/20-128-4-28/65

of 2-mercaptobenzothiazol derivatives as compared with sulphene-amide compounds. This regulation possibility of the vulcanization dynamics by suitable accelerators is of high technical importance. The use of accelerator (2) preferably used as against (1) for rubber mixtures with highly disperse furnace soot is finally discussed. The resulting vulcanization kinetics also favors the higher binding strength of multilayered rubber products (Ref 4), and increases the resistance of the vulcanizates to repeated deformation (Ref 1). There are 3 figures, 1 table, and 4 Soviet references.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(Scientific Research Institute of the Tire Industry)

PRESENTED: May 26, 1959, by A. A. Balandin, Academician

SUBMITTED: May 26, 1959

Card 3/3

FRASE I BOOK EXPLOITATION

307/4984

International symposium on macromolecular chemistry. Moscow, 1960.

Mezhdunarodnyy simpozium po makromolekulyarnoy khimii SSSR, Moskva, 14-18 iyunya 1960 g.; doklady i avtorferity. Sektzia III. (International Symposium on Macromolecular Chemistry Held in Moscow, June 14-18, 1960) Papers and Summaries) Section III. [Moscow, Izd-vo AN SSSR, 1960] 469 p. 55,000 copies printed.

Tech. Ed.: P. B. Kashina.

Sponsoring Agency: The International Union of Pure and Applied Chemistry. Commission on Macromolecular Chemistry.

PURPOSE: This book is intended for chemists interested in polymerization reactions and the synthesis of high molecular compounds.

COVERAGE: This is Section III of a multivolume work containing papers on macromolecular chemistry. The articles in general deal with the kinetics of polymerization reactions, the synthesis of special-purpose polymers, e.g., ion exchange resins, semiconductor materials, etc., methods of catalyzing polymerization reactions, properties and chemical interactions of high molecular materials, and the effects of various factors on polymerization and the degradation of high molecular compounds. No personalities are mentioned. References given follow the articles.

Rabek, T. I., and J. Kozmider (Poland). Chlorination of Phenol-Formaldehyde Resins 27

Alexandru, I., M. Orla, and A. Ciocanel (Romania). Glycoethoxy and Aminopropyl ethers of Polyvinyl Alcohol 34

Kaiborish, A. Ya., G. Ya. Gordon, K. I. Maslennikov, Ya. M. Gurevich, L. I. Tsvetkova, and M. A. Kozlov (USSR). Study of the Chemical Conversions of Polycarbonates 44

Pozdniev, R. A., M. S. Poldaninov, and E. M. Polyanova (USSR). Chemical Interaction and Mechanism of the Activating Action of Double Systems of Vulcanization Accelerators 65

Pisarski, J. M., A. V. Vorob'yeva, G. A. Shirokova, and M. P. Koshchinskaya (USSR). Esters of Sulfuric Acid and Polyvinyl Alcohol 73

Molodtsov, Z. T., Kolly, and G. Tsurko (Hungary). The Interaction of Aromatic Amines and Polyvinyl Chloride 79

Gardner, M. A., R. E. Davydov, R. A. Krasnaya, I. M. Krasnaya, L. J. Polk, A. V. Topchilov, and R. M. Torkenko (USSR). The Production of Polymeric Materials Which Exhibit Semiconductor Properties 85

Kilias, J. A., and L. J. Kovacs (Hungary). Chemical Properties of Bipolar Ion-Exchange Resins 93

Gabek, E. I., and J. Maravice (Poland). Effect of the Structure of Organic Amino Compounds on the Properties of Anion Exchange Resins from Polystyrene 102

Saldadze, K. M. (USSR). The Problem of the Effect of the Structure of Ions on Ion-Exchange Processes Between Ionites and Electrolyte Solutions 107

Berlin, A. A., B. I. Kozlov, M. I., and V. P. Parina (USSR). Production and Properties of Some Aromatic Polymers 115

Troshchinskaya, Ye. V., V. I. P. Loev, A. S. Tyulina, S. B. Makarna, D. I. Keredova, and M. I. Kozlov (USSR). Chemical Conversions of Insoluble Copolymers of Styrene 124

Kidman, J. (Poland). Thermal Stability of Strongly Basic Anion Exchange Resins 146 440

S/138/60/000/005/008/012  
A051/A029

AUTHOR: Fel'dshteyen, M.S.

TITLE: On the Vulcanizing Action of Di-2-Benzothiazyl-disulfide (Altax)

PERIODICAL: Kauchuk i Rezina, 1960, No. 5, pp. 28 - 33

TEXT: The structuralizing (vulcanizing) action of the vulcanizing accelerator di-2-benzothiazyl-disulfide (altax) was studied on natural, butadiene-styrene and sodium-butadiene rubbers. The investigated mixtures were prepared on laboratory rollers. The submitted results of the physico-mechanical tests of the investigated mixtures represent the average values of about 15 to 16 experiments. When synthetic rubber is used, i.e., butadiene-styrene and sodium-butadiene rubbers, di-2-benzothiazyl-disulfide has a much greater vulcanizing action than sulfur. 2-mercaptobenzothiazole has a weaker vulcanizing action on mixtures of natural and butadiene-styrene rubbers than di-2-benzothiazyl-disulfide. When the system sodium-butadiene rubber + filler (channel carbon black) + di-2-benzothiazyl-disulfide is heated at 143°C, vulcanizates with a strength of 130 kg/cm<sup>2</sup> are formed. Introduction of 3 to 5 weight parts of di-2-benzothiazyl-disulfide into the

Card 1,3



S/138/60/000/005/008/012  
A051/A029

On the Vulcanizing Action of Di-2-Benzothiazyl-disulfide (Altax)


mixture of butadiene-styrene and sodium-butadiene rubbers makes vulcanization possible at a lowered content of sulfur in the mixtures (no more than 1%) and no activators are necessary. The physico-mechanical characteristics of the vulcanizates are given, which are produced by using di-2-benzothiazyl-disulfide in the absence of the usual vulcanization activators. The fact that vulcanization can be carried out without an activator when using di-2-benzothiazyl-disulfide is explained by the independent structuralizing action of the latter accelerator which leads to the formation of additional transverse links in the spatial structure of the vulcanizate and thus compensates for the action of the usual vulcanization activators. It is pointed out that the vulcanizates obtained by this method are of technical interest as they are equivalent in their physico-mechanical properties to those which are produced by typical activators. The absence of an activator produces less internal friction in the rubbers, which decreases the mechanical loss in repeated deformations (Figure 10). The absence of the activator also reduces the heat formation. Special vulcanizing structures which are formed are responsible for the increased thermal stability of the vul-

Card 2/3

S/138/60/000/005/008/012  
A051/A029

On the Vulcanizing Action of Di-2-Benzothiazyl disulfide (Altax)  
canizates produced. Ther are 11 figures, 1 table and 14 references: 7  
Soviet and 7 English.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(Scientific Research Institute of the Tire Industry)



Card 3/3

FEL'DSHTEYN, M.S.; EYTINGON, I.I.; DOGADKIN, B.A.

Vulcanizing action of bis(oxydiethylenethiuram) disulfide.  
Vysokom.sped. 2 no.1:97-102 Ja '60. (MIRA 13:5)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti.  
(Vulcanization) (Disulfide)

81608

S/190/60/002/02/07/011  
B004/B061

15.9/20

AUTHORS:

Dogadkin, B. A., Fel'dshteyn, M. S., Belyayeva, E. N.

TITLE:

The Action of Binary Systems of Vulcanization Accelerators.  
II. The Chemical Interaction of Accelerators and the  
Mechanism of the Activating Action of Binary Systems

PERIODICAL:

Vysokomolekulyarnyye soyedineniya, 1960, Vol. 2, No. 2,  
pp. 247-258

TEXT: The authors previously (Ref. 1) examined the action of binary accelerator systems on the vulcanization of butadiene - styrene rubber mixtures. The action of such systems on the vulcanization of natural rubber is studied here. The following systems were used: di-2-benzothiazyl disulfide + diphenylguanidine; 2-mercaptobenzothiazole + diphenylguanidine; N-cyclohexyl-2-benzothiazole sulfenamide + diphenylguanidine; N,N'-diethyl-2-benzothiazole sulfenamide + tetramethylthiuram monosulfide. The action of these systems on the vulcanization, the kinetics of sulfur depositing (studied in collaboration with

Card 1/4

81608

The Action of Binary Systems of Vulcanization Accelerators. II. The Chemical Interaction of Accelerators and the Mechanism of the Activating Action of Binary Systems

S/190/60/002/02/07/011  
B004/B061

M. Krasukhina), the temperature dependence of the reactions, and the yield of 2-mercaptobenzothiazole are given in Figs. 1 - 13 and Tables 1 and 2. Fig. 14 shows microphotographs of the conversion of the sulfur which was separated by the reaction of di-2-benzothiazylidisulfide with hydrogen sulfide (taken by M. B. Rozova). The following conclusions are drawn from these data: The accelerator combinations examined can be divided, on the basis of their action during the main period of vulcanization, into a) systems with mutual activation of the accelerators; b) systems with activation of only one (the weaker) accelerator; and c) systems with additive action. The kinetics of the systems a) and b) are characterized by a delay in the initial stages of vulcanization compared with the kinetics of the separately applied components. 2-mercaptobenzothiazole is formed on the interaction of accelerators one of which contains benzothiazole groups, and the other is the hydrogen donor (e.g., di-2-benzothiazylidisulfide + diphenylguanidine). In rubber, this compound arises in all systems with mutual activation, when the

Card 2/4

81608

The Action of Binary Systems of Vulcanization Accelerators. II. The Chemical Interaction of Accelerators and the Mechanism of the Activating Action of Binary Systems

S/190/60/002/02/07/011  
B004/B061

rubber itself acts as a hydrogen donor. The connection between the yield of 2-mercaptobenzothiazole and the vulcanization activity of these systems was determined. A considerable increase in the yield of 2-mercaptobenzothiazole, caused by the formation of  $H_2S$  and its reaction with the disulfide, was observed in the presence of sulfur with systems of disulfides + sulfenamides, or disulfides + organic bases containing nitrogen. In systems where only one accelerator is activated, the yield of 2-mercaptobenzothiazole is much smaller than in systems with mutual activation. Based on these data, a scheme of the mutual activation of accelerators is drawn up, which assumes the formation of an intermediate complex in the initial stage, which decomposes into radicals initiating the polymerization and the reaction of the rubber with sulfur. The possibility on principle of the selection of binary and ternary accelerator systems which guarantee the performance of vulcanization at high temperatures without decreasing the strength of the vulcanizate, was established. There are 14 figures, 2 tables, and 8 references:

Card 3/4

X

81608

The Action of Binary Systems of Vulcanization  
Accelerators. II. The Chemical Interaction  
of Accelerators and the Mechanism of the  
Activating Action of Binary Systems

S/190/60/002/02/07/011  
B004/B061

6 Soviet and 2 US.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(Scientific Research Institute of the Tire Industry)

SUBMITTED: November 2, 1959

Card 4/4

S/138/60/000/012/007/009  
A051/A027

AUTHORS: Fel'dshteyn, M.S., Orlovskiy, P.N., Dogadkin, B.A.

TITLE: The Action of Activators Depending on the Vulcanization Temperature

PERIODICAL: Kauchuk i rezina, 1960, No. 12, pp. 27-31

TEXT: The authors have investigated the action of activators of vulcanization (zinc oxide and calcium hydroxide) on the kinetics of the modulus change and tear resistance of mixtures from butadiene-styrene and natural rubbers depending on the vulcanization temperature. It was established that different metal oxides have a different effect on the nature of transverse bonds formed during the vulcanization process. The nature of these bonds is judged by the change of the modulus of the rubbers depending on the duration and temperature of vulcanization. The nature of the action of the activators is said to be under the significant effect of the type of accelerator and filler included in the composition of the systems being vulcanized (Ref.10). Various systems were investigated containing either zinc oxide or calcium hydroxide (Fig.1), as well as systems containing channel carbon black in the presence of N-morpholyl-2-benzothiazolesulfena-Card 1/10 ✓



S/138/60/000/012/007/009  
A051/A027

# The Action of Activators Depending on the Vulcanization Temperature

mide and zinc oxide (Fig. 2a). Fig.2b shows the pattern of behavior for the vulcanizing system containing a double system of accelerators: altax +  $\Delta\phi\Gamma$  (DFG). Fig.3 and 4 show the action of calcium hydroxide and zinc oxide with an increase in temperature of the vulcanization for mixtures based on butadiene-styrene rubber filled with a highly-dispersed furnace carbon black ( $\chi\chi\phi$ - KhAF type) and containing the accelerators sulfenamide 8T (BT) and N-cyclohexyl-2-benzothiazolesulfenamide (sulfenamide  $\chi$ -Ts). Attention is drawn to the fact that even for mixtures of natural rubber in which calcium hydroxide at the usual temperature of vulcanization is an extremely weak activator, its action (contrary to the action of zinc oxide) is characterized by a positive temperature coefficient of vulcanization according to the modulus and tear-resistance (Fig.5). The established difference between calcium hydroxide and zinc oxide in their effect on the structure of the vulcanizates is explained by the fact that calcium hydroxide is an accelerator of the vulcanization process and a structuralizing agent (Ref.10). The authors conclude that in the presence of the usually applied activator (zinc oxide) an increase in the vulcanization temperature from 143 to 163°C

Card 2/10

S/138/60/000/012/007/009  
A051/A027

The Action of Activators Depending on the Vulcanization Temperature

leads to a decrease in the modulus of the produced vulcanizates. When using calcium hydroxide and elevating the vulcanization temperature (in the same temperature interval as mentioned above) vulcanizates are obtained with elevated values of the modulus. The vulcanization of these mixtures contrary to mixtures with zinc oxide is described by kinetic curves of the modulus change not exhibiting any reversion of the vulcanization process. There are 5 sets of graphs and 13 references: 11 Soviet, 2 English.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(Scientific Research Institute of the Tire Industry)

Card 3/10

S/138/60/000/012/007/009  
A051/A027

The Action of Activators Depending on the Vulcanization Temperature

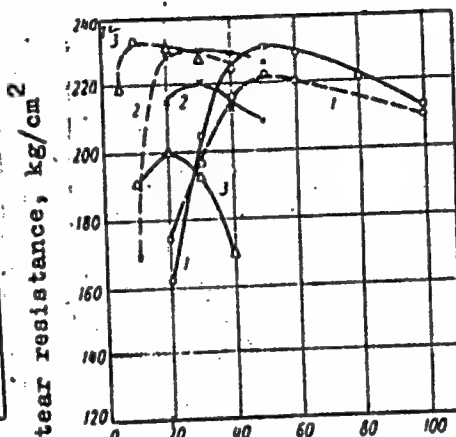
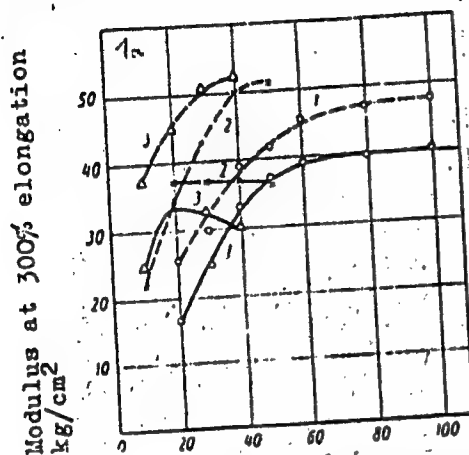


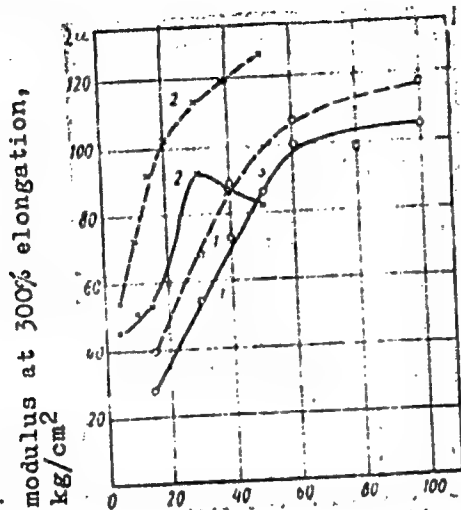
Fig.1: Effect of the activators on the kinetics of change of the modulus and tear resistance in the vulcanization of mixtures based on SKS-30 AM containing 30.0 w.p. of channel carbon black and 1.0 w.p. of sulfenamide

BT. — zinc oxide, - - - calcium hydroxide. 1 - 143°C; 2 - 153°C;  
Card 4/10 3 - 163°C.

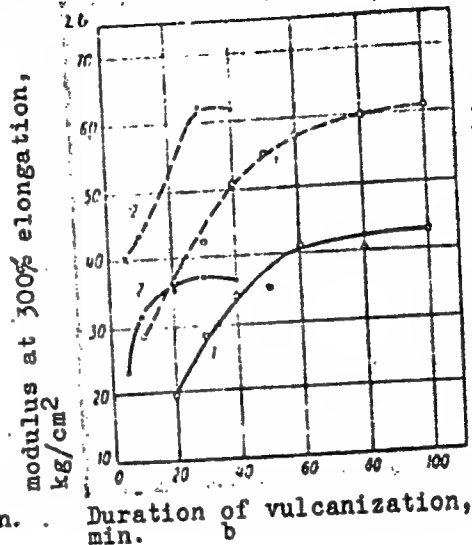
S/138/60/000/012/007/009  
A051/A027

The Action of Activators Depending on the Vulcanization Temperature

Fig. 2:



Duration of vulcanization, min.  
a



Duration of vulcanization, min.  
b

Card 5/10

S/138/60/000/012/007/009  
A051/A027

The Action of Activators Depending on the Vulcanization Temperature

Fig. 2 (continued) Effect of the activators on the kinetics of change of the modulus in the vulcanization of SKS-30 AM mixtures containing 50.0 w.p. of channel carbon black and 1.1 w.p. of sulfenamide M (a) and also 30.0 w.p. of channel carbon black and 0.6 w.p. of altax + 0.75 w.p. of DFC (b):  
—— zinc oxide, - - - calcium hydroxide 1 - 143°C, 2 - 163°C.

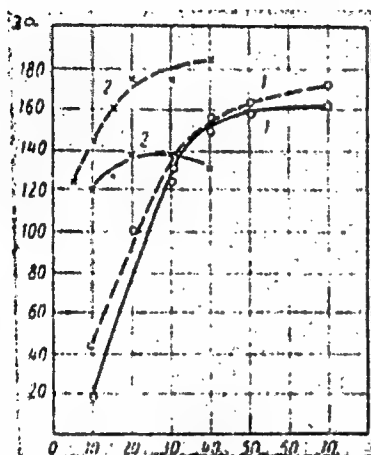
Fig. 3 Effect of the activators on the change kinetics of the modulus and relative elongation of SKS-30 AM mixtures containing 50.0 w.p. of KhAF carbon black when these are vulcanized in the presence of 0.6 w.p. of sulfenamide  
BT: —— zinc oxide, - - - calcium hydroxide, 1 - 143°C; 2 - 163°C.

Card 6/10

S/138/60/000/012/007/009  
A051/A027

The Action of Activators Depending on the Vulcanization Temperature

modulus at 300% elongation  
kg/cm<sup>2</sup>



duration of vulcanization, min.

relative elongation, %

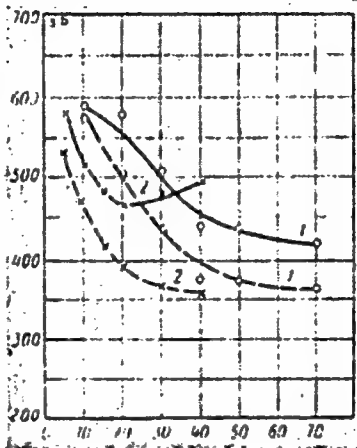


Fig. 3 (con-  
tinued)

Card 7/10

S/138/60/000/012/007/009  
A051/A027

The Action of Activators Depending on the Vulcanization Temperature

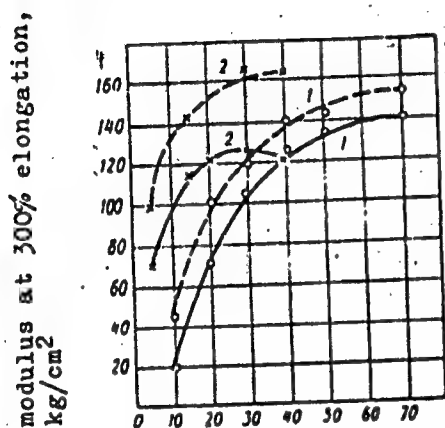


Fig. 4 Effect of the activators on the change kinetics of the modulus in the vulcanization of SKS-3OAM mixtures containing 50.0 w.p. of KhAF channel carbon black and 0.6 w.p. of sulfenamide Ts:  
— zinc oxide; - - - calcium hydroxide.  
1 - 143°C; 2 - 163°C.

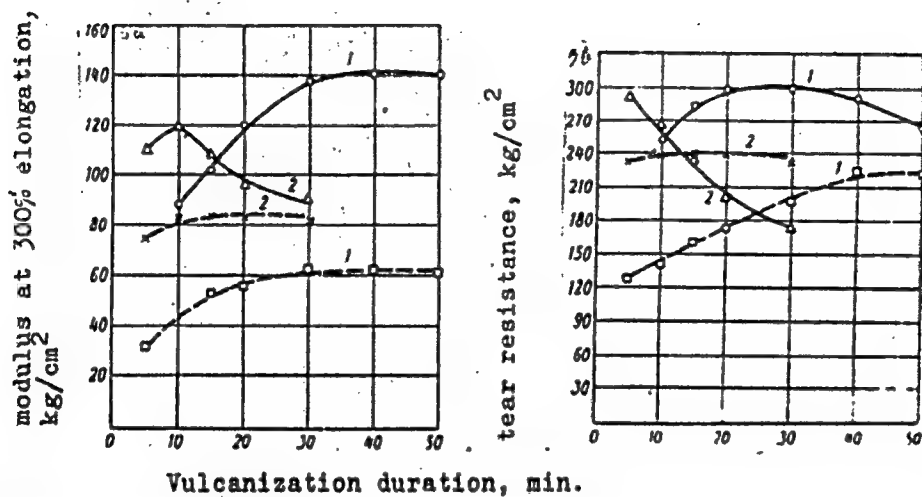
vulcanization duration, min.

Card 8/10

S/138/60/000/012/007/009  
A051/A027

The Action of Activators Depending on the Vulcanization Temperature

Fig. 5



Card 9/10



S/138/60/000/012/007/009  
A051/A027

The Action of Activators Depending on the Vulcanization Temperature

Fig. 5 (continued) Effect of the activators on the change kinetics of the modulus and tear resistance of mixtures from natural rubber containing 40.0 w.p. of KhAF carbon black in their vulcanization in the presence of 0.4 w.p. of vulcaphore BSO: — zinc oxide, - - - calcium hydroxide. 1 - 143°C; 2 - 163°C.

Card 10/10

S/069/60/022/006/001/008  
B013/B066

AUTHORS: Dogadkin, B. A., Skorodumova, Z. V., and Fel'dshteyn, M. S.

TITLE: Effect of the Chemical Nature of the Surface of Carbon Black on Its Interaction With Rubber and Sulfur, and on the Vulcanization Kinetics

PERIODICAL: Kolloidnyy zhurnal, 1960, Vol. 22, No. 6, pp. 663-670

TEXT: The purpose of the present paper was to study the interaction of carbon black with rubber and the dependence of this reaction on the nature of the carbon-black surface. The interaction in the systems rubber - carbon black and rubber - carbon black - sulfur was studied in butadiene-styrene rubber (KC-30A(SKS-30A)). The vulcanization temperature was 143°C. The sorption of rubber from n-heptane solutions (Fig. 1) indicated that the commercial blacks drop in the following order according to the quantity of rubber sorbed per unit surface: Lampblack > thermal black > furnace black > channel black. The type "Feelblack O" corresponds to channel black. The rubber quantity sorbed per surface unit

Card 1/3

Effect of the Chemical Nature of the Surface  
of Carbon Black on Its Interaction With Rubber  
and Sulfur, and on the Vulcanization Kinetics

S/069/60/022/005/001/008  
B013/B066

is the higher, the less oxygen-containing functional groups occur on the black surface. The interaction of rubber with carbon black permitted the establishment of a similar relationship at vulcanization temperature. It was shown that the sulfur chemically bound on the black surface forms additional active centers, and participates in the formation of cross links. Since the opinions on the character of the interaction of carbon black with rubber diverge, this problem requires further thorough investigation. The effect of the oxidation of carbon black on the vulcanization kinetics was tested on the type "Feelblack O" which is used to a considerably extent in the tire industry. It was oxidized for 1.5 hours at 400°C in the air. The oxygen content in the carbon black increased and the low pH was indicative of an increased content of carboxyl and phenol groups. It was found that the increased number of oxygen-containing functional groups on the surface of carbon black reduce the vulcanization rate, and the moduli, the content of bound sulfur, and increase the maximum of swelling. This effect of oxygen-containing functional groups was also confirmed by the data obtained for sulfur by heating the system rubber - carbon black - sulfur with contents of lampblack, channel black,

Card 2/3

Effect of the Chemical Nature of the Surface  
of Carbon Black on Its Interaction With Rubber  
and Sulfur, and on the Vulcanization Kinetics

S/069/60/022/006/001/008  
B013/B066

"Feelblack O", and furnace black (Fig. 6). Samples of channel black which had been subjected to heat treatment were made available by B. V. Lukin and K. A. Pechkovskaya. There are 6 figures, 4 tables, and 12 references: 8 Soviet, 7 US, 1 British, and 2 Australian.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti, Moskva (Scientific Research Institute of the Tire Industry, Moscow) ✓

SUBMITTED: June 6, 1960

Card 3/3

15 9130

28040  
S/081/61/000/015/133/139  
B102/B101

AUTHORS: Fel'dshteyn, M., Orlovskiy, P., Dogadkin, B.

TITLE: Effect of metal oxides as vulcanization activators

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 15, 1961, 602 - 603,  
abstract 151377 (Sb. "Vulkanizatsiya rezin. izdeliy".  
Yaroslavl', 1960, 139 - 155)

TEXT: The effect of  $ZnO$ ,  $Ca(OH)_2$ , and  $MgO$  upon the vulcanization of various rubbers was investigated. In the case of coreless polymerized  $CKB(SKB)$   $ZnO$  decelerates the vulcanization. In butadiene-styrene rubbers, the activating effect of  $Ca(OH)_2$  surpasses that of  $ZnO$ . Substitution of  $ZnO$  by  $MgO$  in tire mixtures increases the life of the tire tread. The activating action of metal oxides depends largely on the type of black.  
[Abstracter's note: Complete translation.]

Card 1/1

15.9130

28949  
S/138/61/000/010/004/009  
A051/A129

AUTHORS: Fel'dshteyn, M.S., Chernomorskaya, I.O., Eyttingon, I.I., Gur'yanova, Ye.N., Dogadkin, B.A.

TITLE: Vulcanizing activity of certain derivatives of 2-mercaptobenzothiazole and their ability to exchange with radioactive di-2-benzothiazyl disulfide

PERIODICAL: Kauchuk i rezina, no. 10, 1961, 15 - 18

TEXT: The characteristic features are given of the vulcanization activity of certain N-benzothiazole-2-thion and 2-thiobenzothiazole derivatives, according to the kinetics of sulfur addition and the change in maximum swelling. The data which characterize this activity indicate that the S substituted derivatives do not affect the rate of vulcanization (the graph), nor the effectiveness of the structuralizing process. The weak effect of vulcanization which is noted is thought to be connected with the presence of sulfur in the rubber mixture. N-benzothiazole-2-thion derivatives are effective accelerators of vulcanization. The results of the investigation into the reaction between N-benzothiazole-2-thion and 2-thiobenzothiazole derivatives on the one hand, and labelled  $S^{35}$  in Card 1/5

Vulcanizing activity ...

28949  
S/138/61/000/010/004/009  
A051/A129

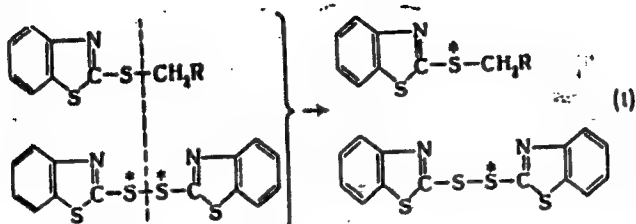
di-2-benzothiazylidisulfide on the other hand are presented. The method of labeled atoms ( $S^{35}$ ) is used to investigate the mobility of the thiobenzothiazolyl radicals in certain N-benzothiazole-2-thion derivatives and 2-thiobenzothiazole derivatives. The reaction scheme of exchange is given as follows:

X

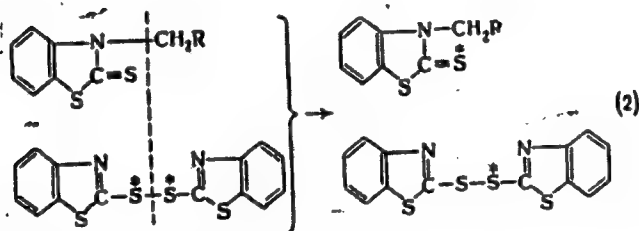
Card 2/6

Vulcanizing activity ...

28949  
9/138/61/000/010/004/009  
A051/A129



OR



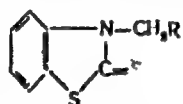
Card 3/6



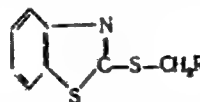
20949 S/138/61/000/010/004/009  
A051/A129

Vulcanizing activity ...

Experimental data showed that there is a direct link between the vulcanizing activity of the investigated compounds and their ability to exchange with the thiobenzothiazolyl radicals. The same elementary act - the formation of the thiobenzothiazolyl radicals - is the basis of both processes. The data of the vulcanizing activity and exchange ability are compared with the results of the structural investigation. It was established that the sharp differences in the vulcanizing activity of the investigated compounds are explained by a difference in their structure. The bond strength of N-CH<sub>2</sub>R in the compounds of the type



is less than the bond strength of S-CH<sub>2</sub>R in compounds:



It is pointed out that amongst derivatives of 2-mercaptobenzothiazole compounds characterized by the presence of the C-S-C grouping do not have an accelerating effect on the vulcanization process, whereas the corresponding sulfenamide C-S-N and disulfide C-S-S compounds are highly-active accelerators of vulcani-

Card 4/5

Vulcanizing activity ...

28949

S/138/61/000/010/004/009  
A051/A129

zation. These reactions of exchange by the thiobenzothiazolyl radicals may thus be used in the synthesis of the corresponding accelerators of vulcanization labelled with radioactive sulfur. There are 3 tables, 1 graph and 5 Soviet-bloc references.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti (Scientific Research Institute of the Tire Industry)

Card 5/6

DOGADKIN, B.A.; FEL'DSHTEYN, M.S.; SKORODUMOVA, Z.V.

Effect of carbon black on the vulcanization kinetics and the type  
of sulfur bonds of the vulcanizates. Koll.zhur. 23 no.6:679-683  
N-D '61. (MIRA 14:12)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti,  
Moskva.

(Carbon black) (Vulcanization) (Sulfur)

EXTINGON, I.I.; FEL'DSHEYN, M.S.; LEVZNER, D.M.

Some heterocyclic N-thiocarbamylsulfenedialkylamides as  
vulcanization agents. Zhur.prikl.khim. 34 no.7:1591-1597 J1 '61.  
(MIRA 14:7)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti,  
Moskva.

(Sulfenamide) (Vulcanization)

15.9130

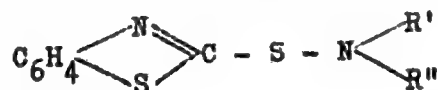
27347  
S/080/61/034/009/017/016  
D204/D305

AUTHORS: Fel'dshteyn, M.S., Chernamorskaya, I.G., Gur'yanova, Ye.N., and Eyttingon, I.I.

TITLE: The vulcanizing activity of sulfenamide derivatives of 2-mercaptobenzothiazole and exchange of thiobenzothiazolyle radicals with radioactive di-2-benzothizyl-sulphide

PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no. 9, 1961, 2073 - 2079

TEXT: The authors wanted to study different sulfenamide derivatives of 2-mercaptobenzothiazole. These are used widely in industry as vulcanization accelerators. They have the general formula



and the vulcanizing effect depends to a large extent on the struc-  
Card 1/4

27347  
S/080/61/034/009/013/016  
D204/D305

The vulcanizing activity of ...

ture of the R' and R" radicals. The derivatives were introduced into a mixture of butadienesterol rubber (CKC-30APM) and a small amount of sulphur (1.5 parts by weight to a 100 parts by weight of rubber) and vulcanized at a 143°. N,N-diethyl-,N-cyclohexyl- and N-oxydiethylene-2-benzothiazolsulfenamide form vulcanizing structures after 30 minutes heating whilst these structures are formed at a later stage of the process in the presence of N,N-dicyclohexyl and N-methyl-N-phenyl-2-benzothiazosulphenamides. This is technologically important because of the rapid viscosity rise. Moreover, the kinetics of the process can be, to a large extent, controlled. As regards the structural factors responsible for differences in vulcanizing activity of the sulphenamides the strength of chemical bond and the ease with which the molecule can form separate radicals is of prime importance. The mechanics of radical exchange has been studied using labelled atoms by Ye.N. Gur'yanova (Ref. 3: sb. dokl. "Vulkanizatsiya rezin". Goskhimizdat, 101, 1954) In the present work the exchange of thiobenzothiazolye groups was studied between the investigated compounds on the one hand and

Card 2/4

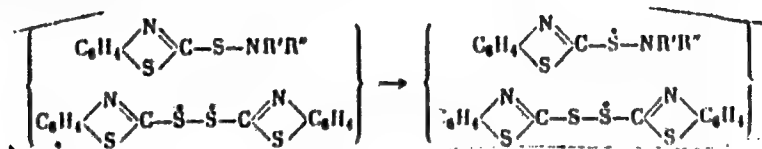
27347

S/080/61/034/009/013/016

D204/D305

The vulcanizing activity of ...

di-2-benzothiazylidisulphide with a labelled  $S^{35}$  atom in the disulphide bridge on the other:



The isotope exchange reaction was effected in toluene at a di-2-benzothiazylidisulphide/sulphenamide ratio of 1:2, avoiding side reactions and separating the rubber mixture components by paper chromatography. As regards exchange capacity the compounds can be classified as follows: N-cyclohexyl- > N-oxydiethylene (N-methyl-N-phenyl)- > N,N-dicyclohexyl- > N-phenyl-2-benzothiazylsulphenamide. This too is of the order of vulcanizing activity. Thus, using sulfenamide accelerators the vulcanizing process is correlated with the exchange capacity of the thiobenzothiazyle radicals i.e. the more firmly the thio-benzothiazyle groups are bound in

Card 3/4

27347

S/080/61/034/003/011/016  
D204/D305

The vulcanizing activity of ...

the sulphenamide compounds the slower the speed of vulcanization. There is still insufficient data to decide whether the reaction proceeds by a radical or bimolecular mechanism and this makes the exact role of the R' and R'' radicals hard to determine. The exchange reactions studied here may be used for the synthesis of sulphenamide derivatives of 2-mercapto-benzothiazole with a labelled radioactive sulphur atom. There are 2 figures, 4 tables, and 4 Soviet-bloc references.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti i fiziko-khimicheskiy institut imeni S.Ye. Karpova (Scientific Research Institute of the Tire Industry and Physico-Chemical Institute im. S.Ye. Karpov)

SUBMITTED: June 24, 1960

Card 4/4



15 9130

2209, 1526, 1451

22437  
S/080/61/034/007/012/016  
D223/D305

AUTHORS: Eytingon, I.I., Fel'dshteyn, M.S., and Pevzner, D.M.

TITLE: The vulcanizing action of some heterocyclic n-thio-carbonylsulpho-dialkylamides

PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no. 7, 1961,  
1591 - 1597

TEXT: Dithiocarbominic acid possesses a high vulcanizing activity and as a rule causes premature vulcanization of resin mixture. It is already known that 2-mercaptobenzothiazol possesses vulcanizing activity which at initial stages of the process is appreciably governed by the nature and number of heteroatoms in the molecule. In this connection, it was interesting to ascertain the effect of heterocyclic groups in N-thiocarbonylsulphodialkylamides on the vulcanizing activity of the latter. With this aim in mind a series of heterocyclic N-thiocarbonylsulphodialkylamides were synthesized containing piperidine, morpholine and piperazine groups. The syn-

Card 1/3

The vulcanizing action of ...

22437  
S/080/61/034/007/012/016  
D223/D305

thesis of these compounds is characterized by sulphoamide groups  
(R' R'')N - C - S - N(R''' R''') (where (R' R'') N-heterocyclic or di-

alkylamine radicals and R''' and R''' - alkyl radical) and it was obtained by the interaction of corresponding piperidine, morpholine and piperazine with sulphocarbons in an alkaline medium with subsequent oxidation condensation of the products of reaction with secondary aliphatic amines. The vulcanizing activity of these compounds was investigated on the mixtures of natural and butadienstyrol (SKS-30 AM) rubbers at a vulcanization temperature of 143°C. To compare the effect of heterocyclic group on the vulcanizing activity of N-thiocarbonylsulphodialkylamides, N,N-diethylthiocarbonylsulphodialkyl amides were chosen. For the natural rubber a typical, unadulterated blend was used containing besides zinc oxide and stearic acid, 3 wt. parts of sulphur. The accelerator used was N,N-diethyl-2-benzotiazolesulphonamide 1.2 wt. parts per 100 wt. parts of rubber. The results on vulcanizing activities are given in graphic form. The results indicate that the vulcanization

Card 2/3

22437

S/080/61/034/007/012/016  
D223/D305

The vulcanizing action of ...

activity of N-thiocarbonylsulphoalkylamides on the basis piperidine, morpholine and piperazine is high, that compounds of this type are highly active accelerators of vulcanization of the blends of natural and butadiene styrol rubbers, yielding better structural and specification properties when compared to the usual accelerators of vulcanization in the production of high-moduli resin. They also show that the kinetics of vulcanization is basically connected with the nature and number of heteroatoms in the molecule of accelerator. It may be seen that morpholine and piperazine, when compared with piperidine, show a greater retarding action at initial stages of the vulcanization process and impart greater stability of the resin blends to premature vulcanization. There are 7 figures, 1 table and 7 Soviet-bloc references. X

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti Moskva (Scientific Research Institute of the Tire Industry, Moscow)

SUBMITTED: October 29, 1960

Card 3/3

FEL'DSHTEYN, M.S.; CHEKHMORSKAYA, I.G.; EYTINGON, I.I.; GUR'YANOVA, Ye.N.;  
DOGADKIN, B.A.

Vulcanizing activity of some 2-mercaptobenzothiazole derivatives  
and their exchangeability with radioactive di-2-benzothiazolyl  
disulfide. Kauch. i rez. 20 no.10:15-18 0 '61. (MIRA 14:12)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti.  
(Vulcanization) (Mercapto group)  
(Benzothiazole)

LAKHMAN, L.S.; FEL'DSHTEYN, M.S.; EYTINGON, I.I.

Using the BTMA accelerator for the vulcanization of cable rubbers.  
Kauch.i res. 21 no.1:7-11 Ja '62. (MIRA 15:1)

1. Moskovskiy kabel'nyy zavod "Elektroprovod" i Nauchno-issledovatel'-  
skiy institut shimoy promyshlennosti.  
(Vulcanization) (Cables)

S/138/62/000/001/003/009  
A051/A126

AUTHORS: Lakhman, L.S.; Fel'dshteyn, M.S.; Eytingon, I.I.

TITLE: The application of the BTMA(BTMA) accelerator for the vulcanization of cable rubber

PERIODICAL: Kauchuk i rezina, no. 1, 1962, 7 - 11

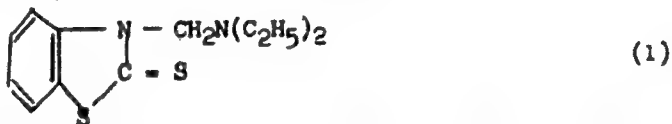
TEXT: Two thiazole accelerators were compared: N-cyclo-hexyl-2-benzothiazol-sulfenamide/sulfenamide - (Ts) and N-(diethylaminomethyl)benzothiazole-2-thione (BTMA), (the latter synthesized at the NIIShP - Scientific Research Institute of the Tire Industry). The action of the two accelerators different in structure was tested, together with thiuram, in the rubber vulcanization process for hose sheathing. The comparative characteristics of the two accelerators showed that sulfenamide Ts ensures a high scorching resistance of the rubber mix in which it is contained and helps to produce vulcanizates with high tensility. This accelerator, however, due to a delayed action in the initial stage of the vulcanizing process, does not meet the requirements called for by the vulcanizing systems of the cable rubbers. The BTMA accelerator renders the mix a high vulcanization rate. Introduction of phthalic anhydride, however,

Card 1/3

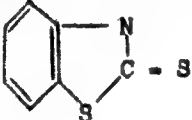
S/138/62/000/001/003/009  
A051/A126

The application of the BTMA accelerator for....

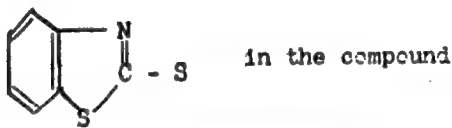
slows up this rate. BTMA offers the necessary resistance to scorching and ensures an increased resistance to thermal aging in the vulcanizates, if the other components of the vulcanizing group (sulfur, thiuram and phthalic anhydride) are added in a different ratio. The high vulcanizing activity in the first stage of vulcanization of the BTMA accelerators is due to the fact that the latter is an N-substituted derivative of captax (2-mercaptobenzothiazole):



Measurements of the exchange-ability with thiobenzothiazolyl radicals between the radioactive altax and this accelerator, and also sulfenamide Ts, showed that

the radical  in compound (1) differs by having a greater mobility

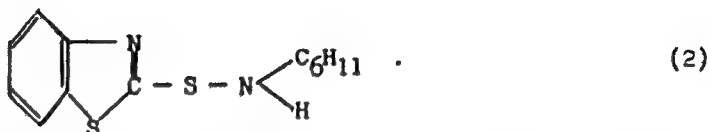
than the radical



Card 2/3

The application of the BIMA accelerator for ...

S/138/62/000/001/003/009  
A051/A126



Thanks to the strong vulcanizing action of BIMA, the sulfur content can be considerably reduced in the vulcanizing mixes which, in turn, strengthens the thermal aging resistance of the cable rubbers. There are 4 figures and 1 table.

ASSOCIATION: Moskovskiy kabel'nyy zavod "Elektroprovod" i Nauchno-issledovatel'skiy institut shinnoy promyshlennosti (Moscow Cable Plant "Elektroprovod" and Scientific Research Institute of the Tire Industry)

Card 3/3



3/17/10

S/138/62/000/003/004/00.  
A051/A126

15.9000  
AUTHOR:

Fol'dshteyn M. S.

TITLE: The action mechanism of vulcanization accelerators

PERIODICAL: Kauchuk i rezina, no. 3, 1962, 13 - 21

TEXT: The author presents some of the action mechanism schemes of accelerators in the vulcanization process, emphasizing their chemical complexity. Experimental data revealing new mechanism facts are analyzed. Recent findings indicate that the main role of the vulcanization activators is the increase of the structuralizing effect, whereby the former do not affect the speed of the sulfur addition to the rubber. Labelled atoms have been used to establish the presence of an exchange reaction between certain sulfur-containing accelerators of vulcanization and radioactive sulfur ( $S^{35}$ ). However, this interaction process cannot be regarded as a simple exchange reaction, due to the absence of symbiosis in the reaction kinetics of exchange and vulcanization, and an almost complete absence of exchange in the compounds, which are effective vulcanization accelerators. N,N-diethyl-2-benzothiazolsulfenamide, as an accelerator of vulcanization, is said to cause an even stronger vulcanizing action in the absence of elementary

Card 1/4

X

S/138/62/000/003/004/006  
A051/A126

The action mechanism of vulcanization accelerators

sulfur, than the sulfur proper. The vulcanizing action of the two accelerators: di-2-benzothiazoldisulfide and N,N-diethyl-2-benzothiazolsulfenamide are presented by the following scheme:  $RS-N(C_2H_5)_2 \rightarrow RS^{\cdot} + ^{\cdot}N(C_2H_5)_2$  (decomposition, forming radi-

cals), where R = . The radicals formed have a structuralizing effect

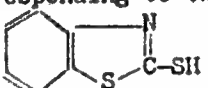
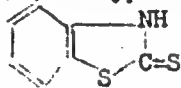
on the rubber, interacting with the latter in two directions. Both directions form polymer radicals. By the interaction of the 8-atom molecular grouping of the sulfur molecule with the corresponding radical, an intermediate polysulfide complex is formed, decomposing with the formation of biradicals  $S_8-x^{\cdot}$  with a varying number of sulfur atoms:  $RS^{\cdot} + S_8 \rightarrow RS-S_8^{\cdot} \rightarrow RS-S_x^{\cdot} + S_{8-x}^{\cdot}$ . The addition reaction of sulfur to rubber is also said to have an ionic nature. The given accelerators initiate the reaction of vulcanization, decomposing into free radicals which, in turn, interact with the sulfur ( $S_8$ ), forming polysulfides. The latter then decompose according to the ionic mechanism. The homolytic nature of the accelerator action is confirmed experimentally, and labelled atoms were used to determine which structural factors are responsible for the differences in the vulcanizing

Card 2/4

The action mechanism of vulcanization accelerators

S/138/62/000/003/CO4/CO6  
A051/A126

action of the sulfenamide compounds. The exchange reaction between the sulfenamide derivatives of 2-mercaptobenzothiazole and labelled  $S^{35}$ , in the disulfide bridge with di-2-benzothiazyliddisulfide, was investigated. Experimental data showed that the investigated sulfenamide compounds are arranged in the following sequence, according to their ability to exchange with the thiobenzothiazole groups: N-cyclohexyl->N-oxydiethylene->N,N-dicyclohexyl->N-phenyl-2-benzothiazolesulphenamide. A study of the derivatives of S-methyl-2-thiobenzothiazole showed that these can be separated into two groups, corresponding to two tautomeric types of 2-

mercaptobenzothiazole (I and II):  (I)  (II).

Their vulcanizing action was compared with their ability to exchange with thiobenzothiazole radicals. The reaction exchange scheme with S-substituted compounds and labelled  $S^{35}$  is analogous to that of the sulfenamide derivatives of 2-mercaptobenzothiazole. Data reveal a direct connection between the vulcanization activity of the investigated compounds and their exchange ability with thiobenzothiazole radicals. In systems with a mutual activation, i.e., combinations of accelerators (disulfides and mercaptanes), and nitrogen-containing organic bases, the vulcanization kinetics are characterized by an initial period of a slow vulcaniza-

Card 3/4

S/138/62/000/003/004/006  
A051/A125

The action mechanism of vulcanization accelerators

tion, where the rate of the process is less than that of the additive action of accelerators. Further development of the process in the system of the accelerators, without the sulfur and rubber, passes through the following stages:  $RS' + R'R''NH \rightarrow RSH + R'R''N'$ ;  $R'R''N' + RSSR \rightarrow RSNR''R' + RS'$ . These stages explain the formation of the two new and very active accelerators - 2-mercaptobenzothiazole RSH and sulfenamide RSNR''R' - and can be regarded as the cause of vulcanization activity increase of the initial binary system of the accelerators. The mutual activating effect in the double system is explained by the chemical action of the accelerators, the formed intermediate complex is capable of decomposing into radicals, interacting with the rubber and sulfur. There are 6 figures, 3 tables and 48 references: 30 Soviet-bloc and 18 non-Soviet-bloc. The references to the two most recent English-language publications read as follows: G. W. Ross, J. Chem. Soc., 2856 (1958); J. R. Shelton, E. T. McDonel. Perevod. Khim. i. tekhnolog. polimerov, no. 4, 109, (1960).

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(Scientific Research Institute of the Tire Industry)

SUBMITTED: At the Conference of Chemical Analysts of the Rubber Industry,  
Moscow, January 1961

Card 4/4

S/080/62/035/005/011/015  
D244/D307

AUTHORS: Fel'dshteyn, M. S., Eytingon, I. I. and Pevzner, D. M.

TITLE: On the vulcanizing action of asymmetric thiuramsulphides containing aliphatic and heterocyclic groups

PERIODICAL: Zhurnal prikladnoy khimii, v. 35, no. 5, 1962, 1115-1119

TEXT: The authors investigated the vulcanizing activity of asymmetric thiuramsulphides containing piperidine, morpholine or piperazine groups together with dimethyl- or dimethylamino groups, in relation to the action of tetramethylthiuramsulphide. The vulcanization was conducted at 143°C. In addition to the accelerators (0.5 parts by weight) the mixture contained 100 parts of natural rubber, 3 parts of S, 5 parts of ZnO, 2 parts of stearic acid and 40 parts of channel carbon black. For butadiene-styrene rubber, 2 parts of S and 50 parts of carbon black were used. The compounds investigated were shown to be highly active accelerators for the natural and synthetic rubbers. In comparison with tetramethylthiuramsulphide, the compounds with heterocyclic groups imparted to  
Card 1/2

On the vulcanizing ...

S/080/62/035/005/011/015  
D244/D307

the rubber mixtures a considerably greater stability to premature vulcanization. The asymmetric thiuramsulphides in which the heterocyclic groups contained two hetero-atoms gave an initial decelerated vulcanization unlike that produced by the aliphatic thiuramsulphides. There are 5 figures and 2 tables.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti (Tire Industry Research Institute)

SUBMITTED: May 8, 1961

Card 2/2

34477

S/020/62/142/004/014/022  
B106/B110

11. 2211  
15. 9201  
AUTHORS:

Dogadkin, B. A., Fel'dshteyn, M. S., and Belyayeva, E. N.

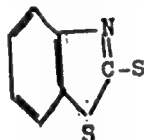
TITLE:

Reaction of di-2-benzo-thiazyl disulfide with rubbers of different structures

PERIODICAL:

Akademiya nauk SSSR. Doklady, v. 142, no. 4, 1962, 828-830

TEXT: The reactivity of rubbers of different structure (natural, butadiene-styrene (CKC-30A(SKS-30A)), sodium-butadiene (food-CKE(SKB)) and butadiene (CKA(SKD)) rubber) toward thiobenzothiazolyl radicals



was studied. In the reaction with rubber these radicals absorb hydrogen from the rubber chain molecules. This leads to the formation of polymeric radicals and 2-mercaptobenzothiazole. A mixture of di-2-benzothiazyl  
Card 1/1

S/020/62/142/004/014/022  
B106/B110

Reaction of di-2-benzo-thiazyl...

disulfide and N-cyclohexyl-2-benzothiazole sulfene amide served as a source of thiobenzothiazolyl radicals, since such a mixture yields more radicals than either component alone. It was found that at 140°C the thiobenzothiazolyl radicals strip off hydrogen neither from the cyclohexyl amide groupings nor from the molecules of the solvent (xylene) they are, however, well capable of rubber dehydrogenation. The most intense dehydrogenation is observed in the sodium-butadiene rubber SKB. Only traces of 2-mercaptobenzothiazole are formed in the case of natural and butadiene rubber SKD which has a 1-4 cis-structure. Natural rubber is not noticeably dehydrogenated even when the experiment is conducted in vacuo. Butadiene-styrene rubber takes an intermediate position between sodium-butadiene and natural rubber. The difference in the dehydrogenation rate of rubbers in the reaction with thiobenzothiazolyl radicals is connected with the existence of different carbon-hydrogen bonds. Tertiary C-H bonds are most easily dehydrogenated. This explains the data in Table 1 (quantity of formed 2-mercaptobenzothiazole as dependent on the structure of the rubber used. The question whether the observed different reactivity of the rubbers toward thiobenzothiazolyl radicals influences the rubber structuralization was also studied. Di-2-benzo-thiazyl disulfide served as radical source. The reaction of the accelerator with the rubber was carried out under the

Card 2/5



Reaction of di-2-benzo-thiazyl...

S/020/62/142/004/014/022  
B106/B110

conditions of press cure in the rubber mass at 143°C. Natural, butadiene-styrene (CKC-30(SKS-30)) and sodium-butadiene rubber SKB with 5.0 parts by weight of di-2-benzo-thiazyl disulfide were studied. The formation of cross links between the chain molecules of rubber was estimated from the swelling in xylene of rubber mixtures with different time of heating. It was found that the capability of the rubbers of being structuralized under the influence of thiobenzothiazolyl radicals increases in the same order as the capability of being dehydrogenated. Natural rubber is least, sodium-butadiene rubber most structuralized. For sodium-butadiene rubber, the number of cross links occurring in the cleavage of one hydrogen atom of rubber by one thiobenzothiazolyl radical is calculated from the maximum swelling of rubber in xylene by using the corresponding monographs. The number of hydrogen atoms absorbed from rubber was calculated from the amount of 2-mercaptobenzothiazole isolated from the rubber mixture by treating it with hot acetone. Table 2 shows the results. It can be concluded from the experimental results obtained that the structuralization of rubbers under the influence of thiobenzothiazolyl radicals is mainly the result of rubber dehydrogenation with subsequent recombination of the polymeric radicals. A paper by B. A. Dogadkin and V. A. Shershnev (Ref. 6: Vysokomolek. soyed., Card 3/5

Reaction of di-2-benzo-thiazyl...

S/020/62/142/004/01/02  
B106/B110

1, no. 1, 58 (1959)) is mentioned. There are 2 figures, 2 tables, and 7 Soviet references.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti  
(Scientific Research Institute of the Tire Industry)

PRESENTED: September 15, 1961, by A. A. Balandin, Academician

SUBMITTED: September 13, 1961

Table 1. Legend: (1) Rubber type; (2) structural formula; (3) number of double bonds in position 4-1, %; (4) amount of 2-mercaptobenzothiazole formed (after a 60 minute continuous heating up to 140°C) in % of the initial disulfide; (5) SKB; (6) SKS-30A; (7) KK; (8) SKD; (9) traces.  
Table 2. Number of cross links formed in rubber SKB on heating with 5.0 parts by weight of di-2-benzo-thiazyl disulfide. Legend: (1) Time of heating, minutes; (2) number of cross links  $N_C \cdot 10^{19}$ , ml<sup>-1</sup>; (3) number of cross links per one H-atom absorbed from rubber; (4) number of H-atoms absorbed from rubber per cross link.

Card 4/5

- CIA-RDP86-00513R0004128300**

DOGADKIN, B.A.; FEL'DSITEYN, M.S.; BELYAYEVA, E.N.

Interaction of di-2-benzothiazyl disulfide with rubbers of various structures. Dokl. AN SSSR 142 no.4:828-830 F '62.  
(MIRA 15:2)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti.  
Predstavleno akademikom A.A.Balandinym.  
(Disulfide)  
(Rubber)

FEL'DSHTEYN, M.S.

Mechanism of the action of vulcanization accelerators. Kauch.1  
rez. 21 no.3:13-21 Mr '62. (MIRA 15:4)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti.  
(Vulcanization)

FEL'DSHTEYN, M.S.; BYTINGON, I.I.; PEVZNER, D.M.

Vulcanizing action of unsymmetrical thiuram sulfides containing  
aliphatic and heterocyclic groups. Zhur.prikl.khim. 35 no.5:  
1115-1118 My '62. (MIRA 15:5)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti.  
(Thiuram sulfides) (Vulcanization)

SKORODUMOVA, Z.V.; FEL'DSHTEYN, M.S.

Molecular sieves and their use in the production of rubber goods.  
Kauch. 1 rez. 22 no.9:41-46 S '63. (MIRA 16:11)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti.

EYTINGON, I.I.; FEL'DSHTYN, M.S.; LEVITIN, I.A.; KAMENSKAYA, S.A.

Investigating some phthalimide derivatives as preventers of premature vulcanization of rubber compounds. Kauch. i rez. 22 no.11:20-23 N '63. (MIRA.17:2)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti i Moskovskiy shinnyy zavod.



BR

ACCESSION NR: AP4041459

S/0138/64/000/006/0016/0020

AUTHOR: Fel'dshteyn, M. S., Zhukova, V. A.

TITLE: Vulcanizing effect of alkylphenolformaldehyde resins

SOURCE: Kauchuk i rezina, no. 6, 1964, 16-20

TOPIC TAGS: resin, alkylphenolformaldehyde, vulcanization, p-tert.-butylphenolformaldehyde, tin chloride, electron paramagnetic resonance, rubber, synthetic rubber, butadiene styrene rubber

ABSTRACT: In order to determine the relationship between the attainable vulcanizing effect and the amount of resin reacting chemically with the rubber, as well as the effect of the accelerator  $\text{Sn Cl}_2 \cdot 2\text{H}_2\text{O}$ , the authors compared the vulcanizing effect of p-tert.-butylphenolformaldehyde resin on butadiene-styrene rubber with that of sulfur vulcanizing systems, both at 163C for up to 140 minutes. A correlation between the effectiveness of the vulcanizing action and the amount of p-tert.-butylphenolformaldehyde resin reacting chemically with the rubber (SKS-30A) was shown. Stannous chloride dihydrate was found to increase the rate of interaction between the rubber and the p-tert.-butylphenolformaldehyde resin but not to change the number of cross-linkages ultimately formed. Experiments showed that after

Card 1/2

ACCESSION NR: AP4041459

120-140 minutes of heating, almost all the added resin became chemically attached to the rubber. In the presence of stannous chloride dihydrate, the reaction between the rubber and the vulcanizing agent proceeded much more rapidly, and after heating for 20 minutes, the amount of resin reacted accounted for 90% of its initial content. The kinetics of the formation of cross-linkages are similar in slope to the curves of the combination of p-tert.-butylphenol-formaldehyde resin with the rubber. Using the method of electron paramagnetic resonance, it was shown that the free radicals formed at the temperature of vulcanization play a great role in the cross-linking action of alkylphenolformaldehyde resins. "S. N. Dobryakov and S. M. Kavun also took part in the work." Orig. art. has: 6 figures, 1 table and 1 chemical formula.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promy\*shlennosti (Scientific Research Institute of the Tire Industry) X

SUBMITTED: 00

DATE: 1971.04

ENCL: 00

SUB CODE: OC, MT

NO REF SOV: 004

OTHER: 006

Card 2/2

DOGADKIN, B.A.; FEL'DSHTEYN, M.S.; BELYAYEVA, E.N.

Interaction of vulcanization accelerators with rubbers of  
various structures. Vysokom. soed. 6 no.4:635-641 Ap '64.  
(MIRA 17:6)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti.

ACCESSION NR: APL026367

S/0138/64/000/003/0025/0029

AUTHORS: Fel'dshteyn, M. S.; Gorelik, M. V.

TITLE: N-hexamethylene-2-benzothiazolsulphenamide as an accelerator in the vulcanization of rubber

SOURCE: Kauchuk i rezina, no. 3, 1964, 25-29

TOPIC TAGS: rubber, vulcanization, vulcanization accelerator, N-hexamethylene-2-benzothiazolsulphenamide, sulphenamide BT, sulphenamide TS, structuration, scorching, scorching resistance, butadiene-styrene rubber

ABSTRACT: The effectiveness of N-hexamethylene-2-benzothiazolsulphenamide (HMBTS) as an accelerator in the vulcanization of rubber was tested in comparison with sulphenamides BT and TS. Various compounds on the base of butadiene-styrene rubbers SKS-30 and SKS-30ARM and on natural rubber were vulcanized at 143C and 163C in the presence of 1.1% of accelerator. The resulting products were subjected to physical and mechanical tests. It was found that the use of HMBTS in association with channel carbon black on a SKS-30ARM base at 143C resulted in a vulcanizate possessing slightly higher values of the elongation modulus than the samples with BT and TS. When used on a base of natural rubber with the addition of 2%

Cord/2

ACCESSION NR: AP4026367

sulfur, the HMBTS-accelerated vulcanizate (produced at 143C) proved superior to the samples containing BT and TS not only in modulus but in strength as well. An increase of the vulcanization temperature to 163C on a natural rubber base reduced somewhat the strength of all the vulcanizates, but here, too, HMBTS was superior. In order to ascertain the formation of C-C bonds during the vulcanization process, tests were performed on compounds on a SKS-30 base, where the resulting products were extracted with chloroform. It was found that the presence of HMBTS caused a higher degree of structuration of the vulcanizate than the BT accelerator, due to the higher reactivity of HMBTS, especially during the main period of vulcanization. Thanks for assistance are given to M. I. Shubina. Orig. art. has: 1 table and 6 charts.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti (Scientific Research Institute of the Tire Industry); Nauchno-issledovatel'skiy institut organicheskikh poluproduktov i krasiteley (Scientific Research Institute of Organic Intermediate Products and Dyes)

SUBMITTED: 00

DATE ACQ: 17Apr64

ENCL: 00

SUB CODE: CH

NO REF SOV: 005

OTHER: 001

Card 2/2

ACCESSION NR: AP4023498

8/0069/64/026/002/0186/0189

AUTHORS: Dogadkin, B.A.; Fel'dshteyn, M.S.; Belyayeva, E.N.

TITLE: Crosslinking of rubbers under the influence of di-2-benzthiazyl disulfide

SOURCE: Kolloidnyy zhurnal, v. 26, no. 2, 186-189

TOPIC TAGS: benzthiazyl disulfide, sulfenamide, synthetic rubber, natural rubber, sodium butadiene, butadiene styrene, elemental sulfur addition, vulcanization, vulcanization temperature, rubber cross-linking, vulcanization accelerator, vulcanization reversion

ABSTRACT: The influence of this accelerator on sodium butadiene, butadienestyrene and natural rubber at vulcanization temperatures (143, 153, 163 and 173C) and the influence of elemental sulfur additions (0.1 - 2%) on the course of this reaction were studied. The cross-linking effect was determined by the degree of swelling in a xylene mixture after heating to the various temperatures. The results are graphed. The cross-linking effect of the accelerator was directly dependent upon the temperature and decreased in the above-mentioned

Card

ACCESSION NR: AP4023498

order of rubber compounds. No reversion was observed, even with natural rubber. Reversion occurred only upon addition of sulfur and increased with increasing sulfur additions and temperatures. This may be assumed to be accompanied by destruction of prior polysulfide bonds and formation of intramolecular cyclic structures. Synthetic rubbers were less subject to reversion, presumably because of the presence of side groups. For best vulcanization results with this accelerator, temperatures of 153-163C and minimal additions of elemental sulfur are recommended. Orig. art. has: 3 figures.

ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promy\*shennosti, Moscow (Scientific Research Institute of Tire Industry)

SUBMITTED: 09Aug63

DATE ACQ: 15Apr64

ENCL: 00

UB CODE: CH

NR REF SOV: 007

OTHER: 000

2/ 2.

Cord

GORELIK, M.V.; KONONOVA, T.P.; FEL'DSHTYEN, M.S.; URAKOVA, I.S.

Sulfenamides based on hexamethylenimine. Zhur. ob. khim.  
34 no. 5:1577-1581 My '64. (MIRA 17:7)

1. Nauchno-issledovatel'skiy institut organicheskikh polu-  
produktov i krasiteley i Nauchno-issledovatel'skiy institut  
shinnoy promyshlennosti.



V. V. S. A70.732565

242

7-15-

— — — — —

1.4 - 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4.0 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 5.0 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 6.0 6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8 6.9 7.0 7.1 7.2 7.3 7.4 7.5 7.6 7.7 7.8 7.9 8.0 8.1 8.2 8.3 8.4 8.5 8.6 8.7 8.8 8.9 9.0 9.1 9.2 9.3 9.4 9.5 9.6 9.7 9.8 9.9 10.0 10.1 10.2 10.3 10.4 10.5 10.6 10.7 10.8 10.9 11.0 11.1 11.2 11.3 11.4 11.5 11.6 11.7 11.8 11.9 12.0 12.1 12.2 12.3 12.4 12.5 12.6 12.7 12.8 12.9 13.0 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.9 14.0 14.1 14.2 14.3 14.4 14.5 14.6 14.7 14.8 14.9 15.0 15.1 15.2 15.3 15.4 15.5 15.6 15.7 15.8 15.9 16.0 16.1 16.2 16.3 16.4 16.5 16.6 16.7 16.8 16.9 17.0 17.1 17.2 17.3 17.4 17.5 17.6 17.7 17.8 17.9 18.0 18.1 18.2 18.3 18.4 18.5 18.6 18.7 18.8 18.9 19.0 19.1 19.2 19.3 19.4 19.5 19.6 19.7 19.8 19.9 20.0 20.1 20.2 20.3 20.4 20.5 20.6 20.7 20.8 20.9 21.0 21.1 21.2 21.3 21.4 21.5 21.6 21.7 21.8 21.9 22.0 22.1 22.2 22.3 22.4 22.5 22.6 22.7 22.8 22.9 23.0 23.1 23.2 23.3 23.4 23.5 23.6 23.7 23.8 23.9 24.0 24.1 24.2 24.3 24.4 24.5 24.6 24.7 24.8 24.9 25.0 25.1 25.2 25.3 25.4 25.5 25.6 25.7 25.8 25.9 26.0 26.1 26.2 26.3 26.4 26.5 26.6 26.7 26.8 26.9 27.0 27.1 27.2 27.3 27.4 27.5 27.6 27.7 27.8 27.9 28.0 28.1 28.2 28.3 28.4 28.5 28.6 28.7 28.8 28.9 29.0 29.1 29.2 29.3 29.4 29.5 29.6 29.7 29.8 29.9 30.0 30.1 30.2 30.3 30.4 30.5 30.6 30.7 30.8 30.9 31.0 31.1 31.2 31.3 31.4 31.5 31.6 31.7 31.8 31.9 32.0 32.1 32.2 32.3 32.4 32.5 32.6 32.7 32.8 32.9 33.0 33.1 33.2 33.3 33.4 33.5 33.6 33.7 33.8 33.9 34.0 34.1 34.2 34.3 34.4 34.5 34.6 34.7 34.8 34.9 35.0 35.1 35.2 35.3 35.4 35.5 35.6 35.7 35.8 35.9 36.0 36.1 36.2 36.3 36.4 36.5 36.6 36.7 36.8 36.9 37.0 37.1 37.2 37.3 37.4 37.5 37.6 37.7 37.8 37.9 38.0 38.1 38.2 38.3 38.4 38.5 38.6 38.7 38.8 38.9 39.0 39.1 39.2 39.3 39.4 39.5 39.6 39.7 39.8 39.9 40.0 40.1 40.2 40.3 40.4 40.5 40.6 40.7 40.8 40.9 41.0 41.1 41.2 41.3 41.4 41.5 41.6 41.7 41.8 41.9 42.0 42.1 42.2 42.3 42.4 42.5 42.6 42.7 42.8 42.9 43.0 43.1 43.2 43.3 43.4 43.5 43.6 43.7 43.8 43.9 44.0 44.1 44.2 44.3 44.4 44.5 44.6 44.7 44.8 44.9 45.0 45.1 45.2 45.3 45.4 45.5 45.6 45.7 45.8 45.9 46.0 46.1 46.2 46.3 46.4 46.5 46.6 46.7 46.8 46.9 47.0 47.1 47.2 47.3 47.4 47.5 47.6 47.7 47.8 47.9 48.0 48.1 48.2 48.3 48.4 48.5 48.6 48.7 48.8 48.9 49.0 49.1 49.2 49.3 49.4 49.5 49.6 49.7 49.8 49.9 50.0 50.1 50.2 50.3 50.4 50.5 50.6 50.7 50.8 50.9 51.0 51.1 51.2 51.3 51.4 51.5 51.6 51.7 51.8 51.9 52.0 52.1 52.2 52.3 52.4 52.5 52.6 52.7 52.8 52.9 53.0 53.1 53.2 53.3 53.4 53.5 53.6 53.7 53.8 53.9 54.0 54.1 54.2 54.3 54.4 54.5 54.6 54.7 54.8 54.9 55.0 55.1 55.2 55.3 55.4 55.5 55.6 55.7 55.8 55.9 56.0 56.1 56.2 56.3 56.4 56.5 56.6 56.7 56.8 56.9 57.0 57.1 57.2 57.3 57.4 57.5 57.6 57.7 57.8 57.9 58.0 58.1 58.2 58.3 58.4 58.5 58.6 58.7 58.8 58.9 59.0 59.1 59.2 59.3 59.4 59.5 59.6 59.7 59.8 59.9 60.0 60.1 60.2 60.3 60.4 60.5 60.6 60.7 60.8 60.9 61.0 61.1 61.2 61.3 61.4 61.5 61.6 61.7 61.8 61.9 62.0 62.1 62.2 62.3 62.4 62.5 62.6 62.7 62.8 62.9 63.0 63.1 63.2 63.3 63.4 63.5 63.6 63.7 63.8 63.9 64.0 64.1 64.2 64.3 64.4 64.5 64.6 64.7 64.8 64.9 65.0 65.1 65.2 65.3 65.4 65.5 65.6 65.7 65.8 65.9 66.0 66.1 66.2 66.3 66.4 66.5 66.6 66.7 66.8 66.9 67.0 67.1 67.2 67.3 67.4 67.5 67.6 67.7 67.8 67.9 68.0 68.1 68.2 68.3 68.4 68.5 68.6 68.7 68.8 68.9 69.0 69.1 69.2 69.3 69.4 69.5 69.6 69.7 69.8 69.9 70.0 70.1 70.2 70.3 70.4 70.5 70.6 70.7 70.8 70.9 71.0 71.1 71.2 71.3 71.4 71.5 71.6 71.7 71.8 71.9 72.0 72.1 72.2 72.3 72.4 72.5 72.6 72.7 72.8 72.9 73.0 73.1 73.2 73.3 73.4 73.5 73.6 73.7 73.8 73.9 74.0 74.1 74.2 74.3 74.4 74.5 74.6 74.7 74.8 74.9 75.0 75.1 75.2 75.3 75.4 75.5 75.6 75.7 75.8 75.9 76.0 76.1 76.2 76.3 76.4 76.5 76.6 76.7 76.8 76.9 77.0 77.1 77.2 77.3 77.4 77.5 77.6 77.7 77.8 77.9 78.0 78.1 78.2 78.3 78.4 78.5 78.6 78.7 78.8 78.9 79.0 79.1 79.2 79.3 79.4 79.5 79.6 79.7 79.8 79.9 80.0 80.1 80.2 80.3 80.4 80.5 80.6 80.7 80.8 80.9 81.0 81.1 81.2 81.3 81.4 81.5 81.6 81.7 81.8 81.9 82.0 82.1 82.2 82.3 82.4 82.5 82.6 82.7 82.8 82.9 83.0 83.1 83.2 83.3 83.4 83.5 83.6 83.7 83.8 83.9 84.0 84.1 84.2 84.3 84.4 84.5 84.6 84.7 84.8 84.9

D. G. Gerasimov, B. A.; Feinberg, M. S.; Kolyayeva, N. B.

Relationship between vulcanization and electrical properties of polyethylene

Высокотемпературный комплекс, соед. в. 6, no. 4, 1964, 515-521.

Other: rubber, natural rubber, butadiene styrene rubber, 1,2 or butadiene  
vulcanization, vulcanization accelerators, sulfur, zinc, natural,  
synthetic rubber, SBR rubber

[illegible]

Card 1/2



FEL'DISHTEYN, M.S.; ZHUKOVA, V.A.

Vulcanizing effect of alkylphenol-formaldehyde resins.  
Kauch. i rez. 23 no.6:16-20 Je '64. (MIRA 17:9)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti.

FEL'DENITEYN, M.S.; GORELIK, M.V.; BESKINA, I.G.; KONONOVA, T.P.

Comparative study of the vulcanization activity of sulfenamide and bis-sulfenamide derivatives of benzothiazole. Zhur. prikl. khim. 37 no.12:2696-2701 D '64.

(MIRA 18:3)

1. Nauchno-issledovatel'skiye instituty shinnoy promyshlennosti i organicheskikh poluproduktov i krasiteley.

**"APPROVED FOR RELEASE: Monday, July 31, 2000**

**CIA-RDP86-00513R000412830**

**APPROVED FOR RELEASE: Monday, July 31, 2000**

**CIA-RDP86-00513R000412830C**

L 00864-66 ENT(m)/EPF(c)/EWP(j) RM

ACCESSION NR: AP5016634

UR/0138/65/000/006/0008/0012  
678.043/.044.004.12 337

AUTHORS: Fel'dshteyn, M. S.; Gorelik, M. V.; Pevzner, D. M.; Sakhashchik, L. V.

TITLE: 2-(aminodithio)benzthiazoles as agents and accelerators of vulcanization

SOURCE: Kauchuk i rezina, no. 6, 1965, 8-12

TOPIC TAGS: vulcanization, vulcanizate, aminodithiobenzthiazole, catalyst, vulcanized rubber

ABSTRACT: The investigation was undertaken to substantiate the work of J. G. Lichty, J. O. Cole, A. F. Hardman, et al (Ind. Eng. Chem., Prod., 2, 1, 16, 1963) on 2-(morpholinodithio) benzthiazole (I), and to characterize vulcanizing and catalytic properties of 2-(piperidinodithio) benzthiazole (II). The kinetics of vulcanization and the effect of carbon black and sulfur on the vulcanization were determined and compared with the results produced on N,N'-dithiomorpholine (III). It was found that the action of I and II is similar to that of III. The speed and effectiveness of vulcanization of II and III for sulfur-free rubber mixtures are superior to I and to thiuramdisulfides. In sulfur-containing rubber mixtures, 2-(aminodithio)benzthiazoles act as high-efficiency vulcanizing accelerators. In comparison with 2-benzthiazolsulfenamides, the former yield

Card 1/2

L 00884-66

ACCESSION NR: AP5016634

15, 44, 55 15 10  
vulcanizates from natural rubber and butadiene-styrene synthetic rubber which have greater tensile strength than the latter. The effect of 2-(morpholinedithio) benzthiazole is inferior to sulfenamide-M but similar to sulfenamide-ET. M. I. Shubina collaborated in the experiments. Orig. art. has: 1 table, 7 graphs, and 3 formulas.

44, 55  
ASSOCIATION: Nauchno-issledovatel'skiy institut shinnoy promyshlennosti (Scientific Research Institute for Rubber Tire Industry); Nauchno-issledovatel'skiy institut organicheskikh poluproduktov i krasitelov (Scientific Research Institute of Organic Intermediates and Dyes)

SUBMITTED: 00

44, 55  
ENCL: 00

SUB CODE: 00, G8

NO REF SOV: 004

OTHER: 005

Card 2/2 DP

Authors: Belidshteyn, M. S.; Beskina, I. I.; Sulivanova, V. A.

Subject: Sulfenamide derivatives of 2-benzthiazole as vulcanization accelerators

Keywords: Sulfenamide, 2-benzthiazole derivative, vulcanization, accelerator, radical

ABSTRACT: The exchange of thiobenzthiazolyl radical between 2,2'-bis(2-benzthiazyl)disulfide and *N*-cyclohexane (I) and *N,N*-dicyclohexyl-2-benzthiazosulfenamides (II) was studied in order to elucidate the mechanism of sulfenamide derivatives of 2-benzthiazole used as vulcanization accelerators. The activation energy of the (I) and (II) reactions are 15.0 and 16.5 kcal/mol, respectively. The rate of the radical exchange in reactions (I) and (II) depends on the concentration of the accelerators which indicates that the S-N bond is weak. The large difference in the activation energy of reactions (I) and (II) is due to the difference in the

Card 1/1



-----

1. The first part of the report is a summary of the information received from the source. It is a brief, concise statement of the facts as they are known to the source. It is not a detailed account of the events, but a summary of the information received from the source.

2. The second part of the report is a detailed account of the events. It is a narrative of the events as they occurred, and it is written in a clear, concise, and factual manner. It is not a story, but a report of the events as they occurred.

3. The third part of the report is a summary of the information received from the source. It is a brief, concise statement of the facts as they are known to the source. It is not a detailed account of the events, but a summary of the information received from the source.

4. The fourth part of the report is a detailed account of the events. It is a narrative of the events as they occurred, and it is written in a clear, concise, and factual manner. It is not a story, but a report of the events as they occurred.

Card 1/1

FEL'DSHTeyN, M.S.; BESKINA, I.G.; GUR'YANOVA, Ye.N.

Mechanism underlying the action of 2-benzothiazole sulfenamide derivatives as vulcanization accelerators. Zhur. prikl. khim. 38 no.5:1118-1121 My '65. (MIRA 18:11)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti i Fiziko-khimicheskiy institut imeni L.Ya. Karpova.

L 41265-66 EWT(m)/ENP(j) IJP(c) JWD/RM

ACC NR: AP6022445 (A)

SOURCE CODE: UR/0069/66/028/002/0214/0217

AUTHOR: Dogadkin, B. A.; Skorodumova, Z. V.; Fel'dshteyn, M. S. 30  
8

ORG: Scientific-Research Institute of the Tire Industry, Moscow (Nauchno-issledovatel'skiy institut shinnoy promyshlennosti)

TITLE: The influence of carbon black on the interaction of rubber with sulphur and accelerators 15 15

SOURCE: Kolloidnyy zhurnal, v. 28, no. 2, 1966, 214-217

TOPIC TAGS: butadiene styrene rubber, dehydrogenation, vulcanization, carbon black

ABSTRACT: Two series of experiments were carried out to define the influence of alkaline carbon blacks in accelerating the attachment of sulphur and improving its maximal combined content, improving the modulus, and lowering peak value of swelling. The first concerned effects of channel black and Philback 0 on dehydrogenation in the butadiene styrene rubber 15 system SKS-30A (100 parts by weight) plus 7 parts di-2benzthiazyl disulfide plus 50 parts carbon black. The second series utilized the same system with an addition of 3 parts sulphur. Dehydrogenation and interaction of rubber and sulphur are both activated by the presence of Philback 0. Channel black promotes attachment of accelerator radicals to molecular chains

Card 1/2

UDC: 541.182:546.22

ACC NR: AP6022445

of the rubber, but suppresses the other named reactions. Experimental results served to clarify modifications of vulcanization kinetics induced by the presence of various types of carbon black. Orig. art. has: 6 figures.

SUB CODE: 07,11/ SUBM DATE: 03May65/ ORIG REF: 007

Card 2/2 *LC*

L 44933-66 EWT(m)/Y WE

ACC NR: AP6029039

(A)

SOURCE CODE: UR/0413/66/000/014/0055/0055

INVENTOR: Chertkov, Ya. B.; Zrellov, V. N.; Shchagin, V. M.; Fel'dshcheyn, M. S.;  
Rybakov, K. V.

ORG: none

TITLE: Method of removing minute contaminants from [jet] fuels. <sup>117</sup> Class 23,  
No. 183859

B  
46

SOURCE: Izobret prom obraz tov zn, no. 14, 1966, 55

TOPIC TAGS: jet fuel, fuel additive, fuel contamination, ~~coagulant-additive~~  
*coagulation*

ABSTRACT: An Author Certificate has been issued for a method of removing minute contaminants from [jet] fuels as per Author Certificate No. 173363 but involving sulfenamide derivatives [unspecified] of 2-benzothiazole as the coagulating additive [Author Certificate No. 173363 concerned a method of removing minute contaminants by filtration, featuring the addition to the fuel of octadecylamidoxylbutyric acid [sic] as a coagulating additive to increase the speed and degree of purification]. [SM]

SUB CODE: 21/ SUBM DATE: 02Nov63/ ATD PRESS: 506/

Card 1/1 *ac/h*

UDC: 665.541

ACC NR: AP7002972 (A) SOURCE CODE: UR/0413/66/000/024/0068/0068

INVENTOR: Peschanskaya, R. Ya.; Gorelik, M. V.; Belova, L. N.; Fel'dshteyn, M. S.

ORG: None

TITLE: A method for sulfur vulcanization of raw rubber. Class 39, No. 189566  
[announced by the Scientific Research Institute of Rubber and Latex Products (Nauchno-  
issledovatel'skiy institut rezinovykh i lateksnykh izdeliy)]

SOURCE: Izobreteniya, promyshlennyye obraztsy, tovarnyye znaki, no. 24, 1966, 68

TOPIC TAGS: vulcanization, rubber, sulfur, compound

ABSTRACT: This Author's Certificate introduces a method for sulfur vulcanization of raw rubber in the presence of sulfenamide accelerators. To increase the scorching resistance of rubber stocks and to produce high-modulus rubber, N-cyclohexyl-N'-(cyclohexamethylenethiocarbamylthio)-2-benzothiazolsulfenamide is used as the sulfenamide accelerator.

SUB CODE: 11/ SUBM DATE: 30Oct65

Card 1/1

UDC: 678.4.044.47

$$r = A_1 A_2 : AEP/EWP() \quad A_1 = PC - 4.11 - 4.11 - 4.11 \quad A_2 = 0$$

.. APR 21 1969

[illegible]

№ 3 Д.: Каменский, Л. П.; Асеева, В. В. (А. 1979) - 3.

• "Doubtful; public relations" •

100. Коллекция: Товары для дома, к. 1, п. 1

resin, phenolformaldehyde resin, glycidic ester, furan acid,  
plastic

This Author Certificate presents a method for modifying phenolformal-  
dehyde resins with organic esters. Organic esters of formaldehyde and  
phenol can be modified with organic esters to produce a new class of  
reinforced plastics.

ANALYSIS: none

... : 09Jun64

ENCL: 00

000

OTHER: 4 000

Card 17

GRINBAUM, Ya.; FEL'DSHEYN, V.

Movable dryers for ear corn. Muk.-elev. prom. 25 no.4:30 Ap  
'59. (MIRA 13:1)

1.Zastavskiy khlebopriyemnyy punkt (for Grinbaum). 2.Odesskoye  
oblastnoye upravleniye Goskhlebinspektsiya (for Fel'dshteyn).  
(Corn (Maize)--Drying)



SOV/169-59-3-3193

Translation from: Referativnyy zhurnal, Geofizika, 1959, Nr 3, p 160 (USSR)

AUTHORS: Fel'dshteyn, Ya.I., Kurdina, Ye.I.

TITLE: The Magnetic Variations in the Region of the Aurora Polaris 12  
Zone

PERIODICAL: V sb.: Probl. Arktiki, Nr 3, Leningrad, "Morsk. Transport, 1958,  
pp 53 - 59

ABSTRACT: This is a description of investigations of the geographic distribution of the variations of the magnetic elements D, H, Z in the region of the Dixon geophysical observatory. The magnetic variations were recorded at different distances from the observatory by a mobile Brunelli magnetic station. All investigations were related to the stable state of the magnetic field. The greatest difference in shape and phase of the variations was observed with the Z-component at a distance of

Card 1/2

SOV/169-59-3-3193

The Magnetic Variations in the Region of the Aurora Polaris Zone

800 km from Dixon (the variations in Z are often detected in the antiphase). Noticeable changes in the character of the Z-variations were not observed at distances of about 10 km from Dixon. The Brunelli magnetic station gives a qualitative record of the magnetic field variations in a wide range of changes.

M.A. Belousova



Card 2/2

FEL'DSHTEYN, Ya.I.

Geographic distribution of auroras in the western part of the  
Soviet Arctic. Probl.Arkt. no.4:45-49 '58. (MIRA 11:12)  
(Auroras)

**PLATE 1 BOOK REPRODUCTION**

1007/2019

Problem Article, *Aberrant sci. vj.*, pp. 7 (Problem of the Article Collection of Article, No. 7) *Uniquely, It is a "Narrowly Uniquely"*, 1979. 135 p. 500 copies printed. ID00 0077

Увед. Администрация муниципального района  
"Самарский район" Самарской области

Authors: V.V. Poloviy, B.I. Kabanov, A.A. Orlov, P.A. Gerdynskiy (Department of Chemistry, I.M. Seleznev, L.O. Epifanovskiy, A.A. Kirillov, Ye.S. Karlovich, V.V. Lantsov, I.V. Kabanov, A.I. Orlov, I.I. Potomkin, and B.V. Poloviy) Techn. Institute.

**REMARKS:** The publication is intended for geographers, oceanographers, and particularly for all those interested in the studies of Arctic and Antarctic regions.

concluded. This collection of 19 articles is the result of a series of publications dealing with problems of the Arctic and Antarctic. The articles deal mainly with the meteorological conditions in the Arctic and Antarctic regions, the meteorological conditions in the various parts of the Arctic, types of atmospheric circulation in the Arctic, distribution of the meteorological stations in the Soviet Arctic, specific storms and their effects on the meteorological stations, the meteorological conditions in the mountains and atmospheric circulation, localized ice drift information on Soviet articles, ice particularities and specializations. References accompany most of the articles. No particularities are mentioned.

## TABLE OF CONTENTS

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 | 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 | 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 | 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 | 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 | 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 | 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 | 585 | 586 | 587 | 588 | 589 | 590 | 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 | 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 | 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 | 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 | 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 | 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 | 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 | 705 | 706 | 707 | 708 | 709 | 710 | 711 | 712 | 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 | 721 | 722 | 723 | 724 | 725 | 726 | 727 | 728 | 729 | 730 | 731 | 732 | 733 | 734 | 735 | 736 | 737 | 738 | 739 | 740 | 741 | 742 | 743 | 744 | 745 | 746 | 747 | 748 | 749 | 750 | 751 | 752 | 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 | 761 | 762 | 763 | 764 | 765 | 766 | 767 | 768 | 769 | 770 | 771 | 772 | 773 | 774 | 775 | 776 | 777 | 778 | 779 | 780 | 781 | 782 | 783 | 784 | 785 | 786 | 787 | 788 | 789 | 790 | 791 | 792 | 793 | 794 | 795 | 796 | 797 | 798 | 799 | 800 | 801 | 802 | 803 | 804 | 805 | 806 | 807 | 808 | 809 | 810 | 811 | 812 | 813 | 814 | 815 | 816 | 817 | 818 | 819 | 820 | 821 | 822 | 823 | 824 | 825 | 826 | 827 | 828 | 829 | 830 | 831 | 832 | 833 | 834 | 835 | 836 | 837 | 838 | 839 | 840 | 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 | 849 | 850 | 851 | 852 | 853 | 854 | 855 | 856 | 857 | 858 | 859 | 860 | 861 | 862 | 863 | 864 | 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 | 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 | 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 | 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 | 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 | 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 | 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 | 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 | 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 | 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 | 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 | 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 | 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 | 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 | 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 | 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 | 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |